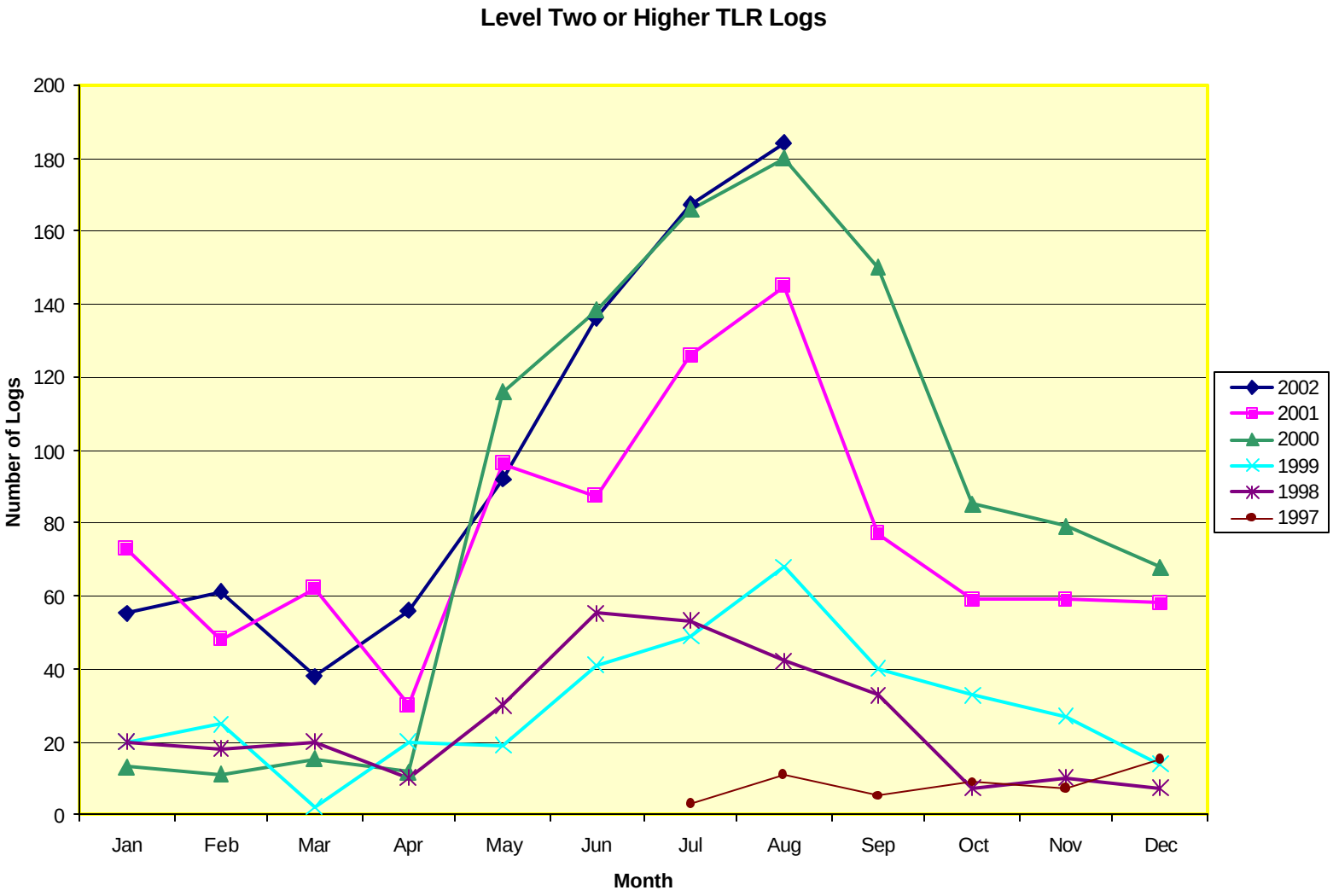
Real Time Operating System Limit

Welcome to Chattanooga

Wai-Ran (Warren) Wu
Transmission System Reliability

Transmission Loading Relief (TLR)



Purpose

- During past few years, unprecedented thermal/voltage problems have caused numerous TLRs (Transmission Loading Relief) events on the Eastern Interconnection.
- The granting of simultaneous transmission services based on non-simultaneous contract path transfer capabilities continued to be major grid operational problems
- Stability concerns in real time system operation

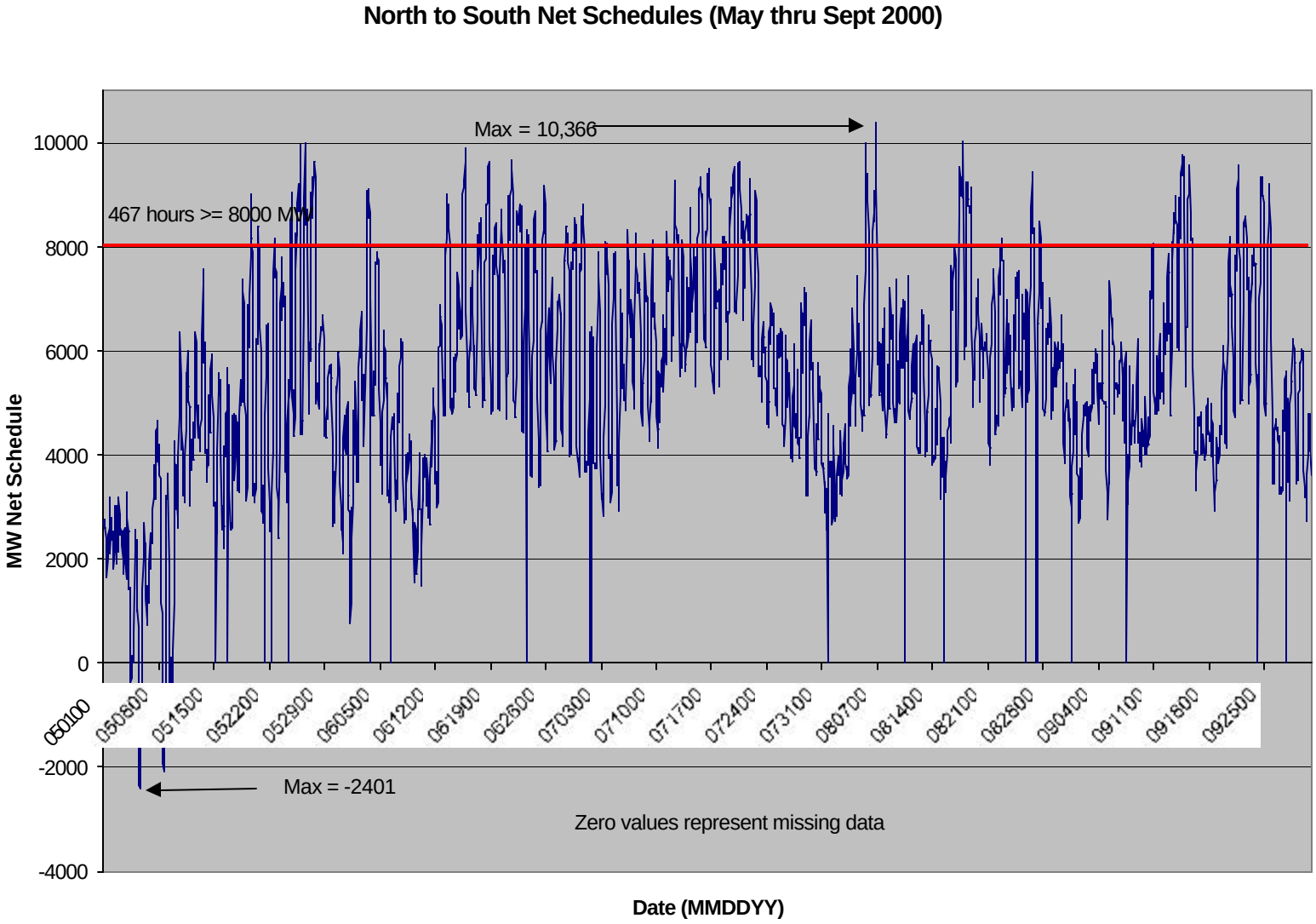
Reliability Concerns

- Exponential growth in transmission transactions
- Increased number of new generators without adequate transmission
- Basing power transactions on the “contract path” without regard to how power actually flows

Real Time Operational Variables

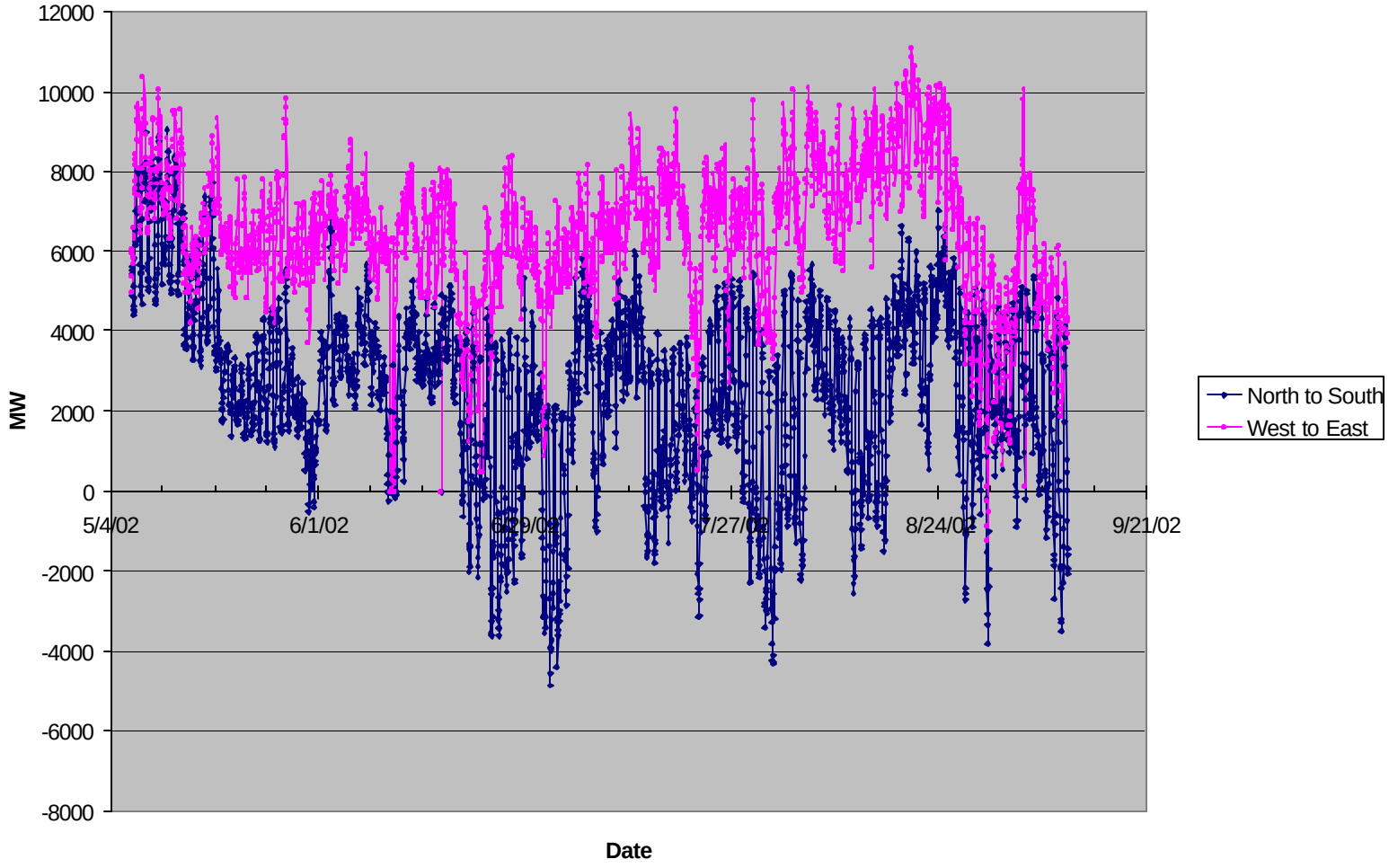
- **Non-Simultaneous Thermal Transfer Study**
- **Eastern Interconnection System Topology**
  - **Transmission Configuration**
  - **Generation Availability**
- **Simultaneous Thermal and Voltage Transfer Study**
- **Simultaneous transfer patterns and their impact on system constraints**
    - **North to south**
    - **West to east**
    - **South to north**
    - **East to west**
- **Real Time MW and MVAR Generation and Load Dispatches**

Summer 2000 Market Activities

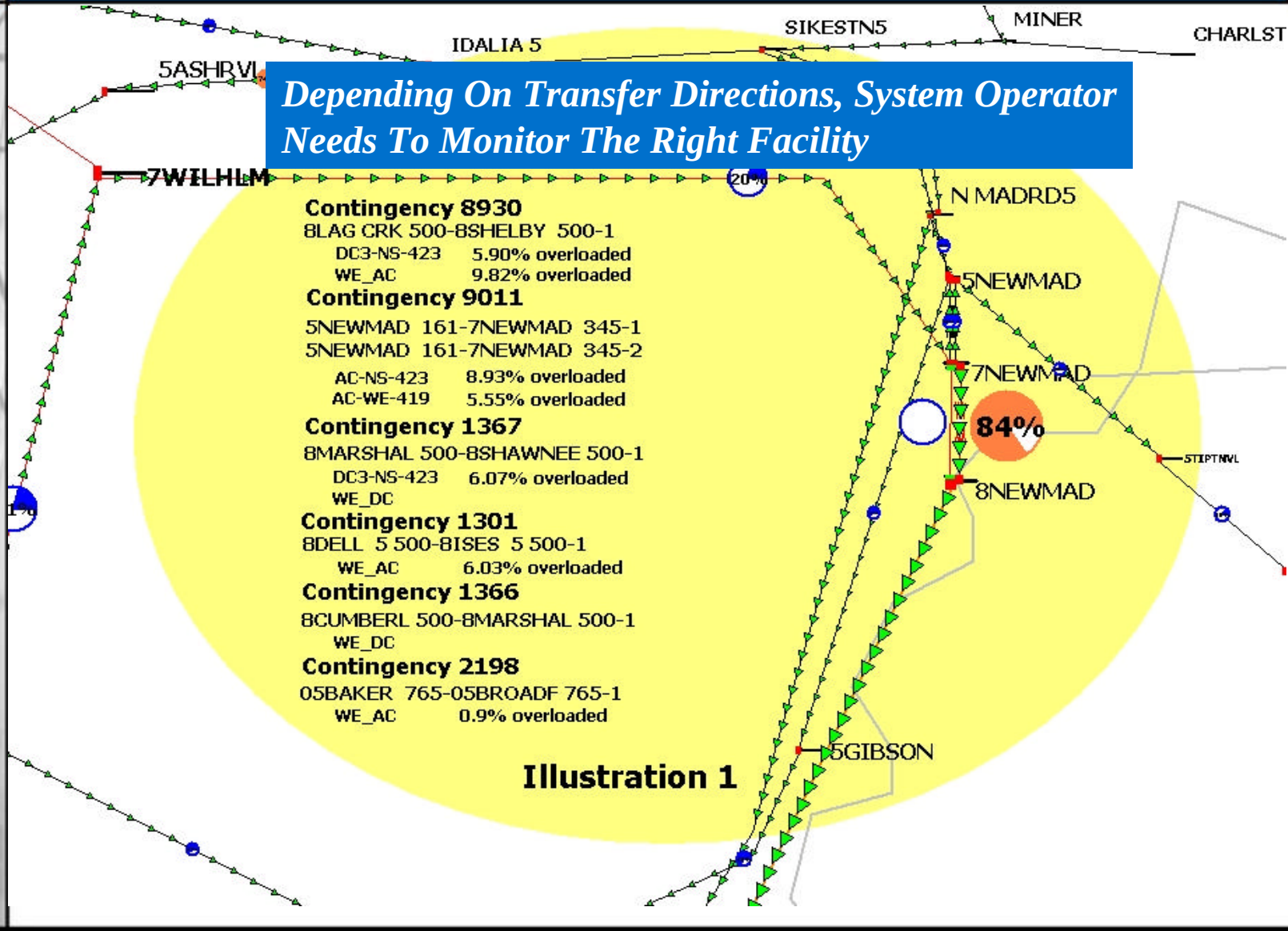


Summer 2002 Market Activities

Hourly Schedules Summer 2002 Period from 5/6/02 to 9/10/02

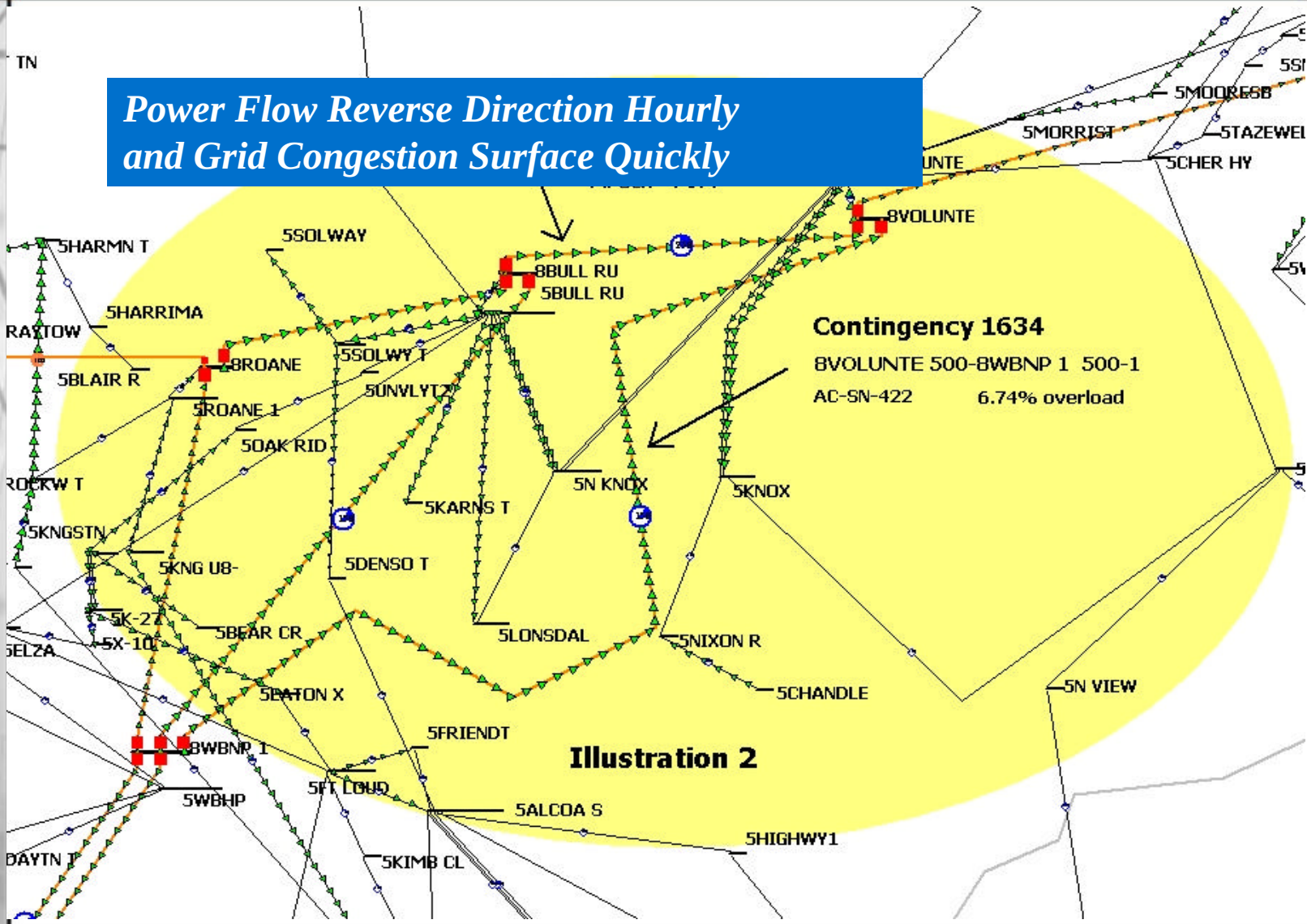


NORTH TO SOUTH TRANSFER CONSTRAINT



Depending On Transfer Directions, System Operator Needs To Monitor The Right Facility

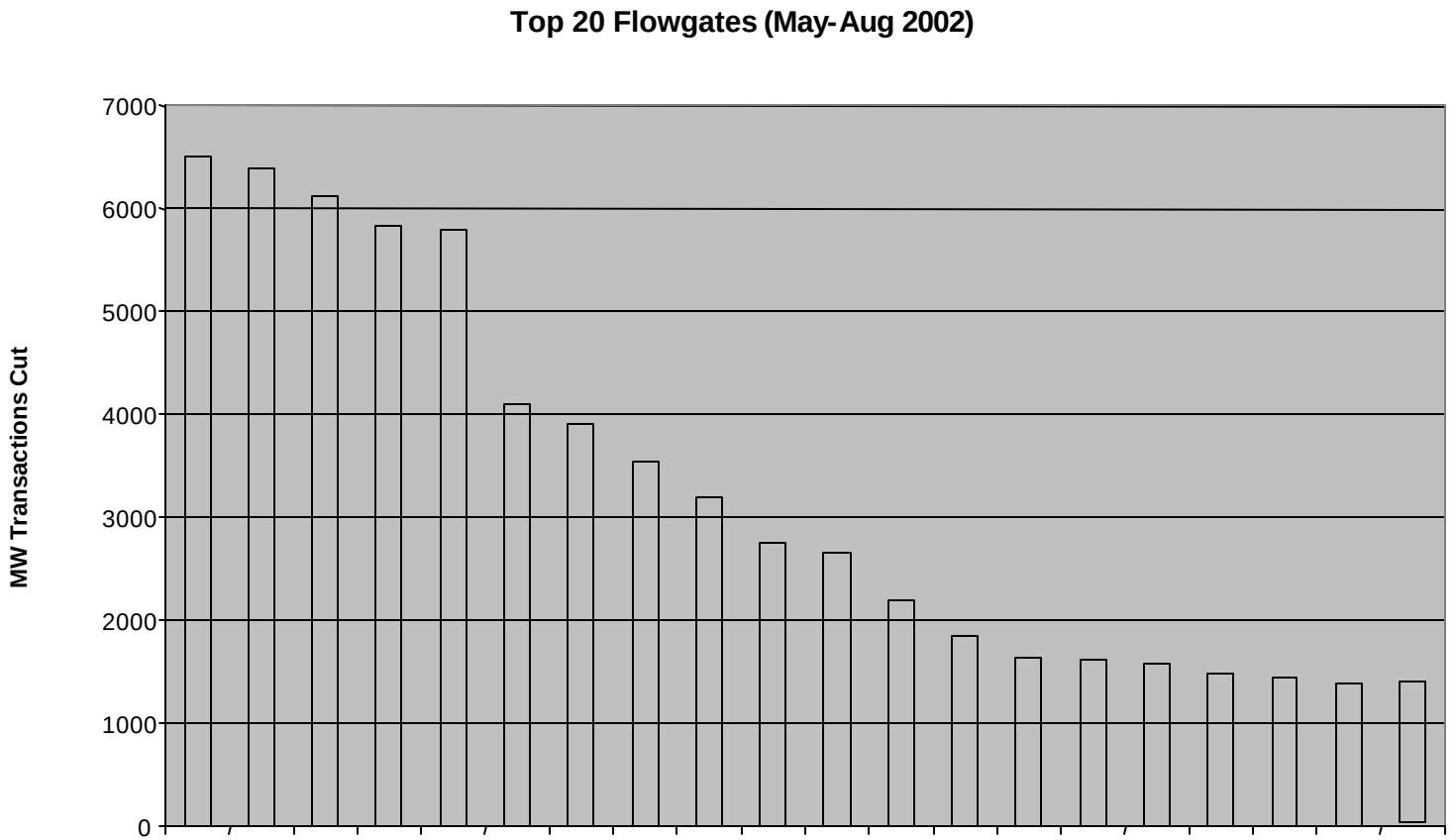
SOUTH TO NORTH TRANSFER CONSTRAINT



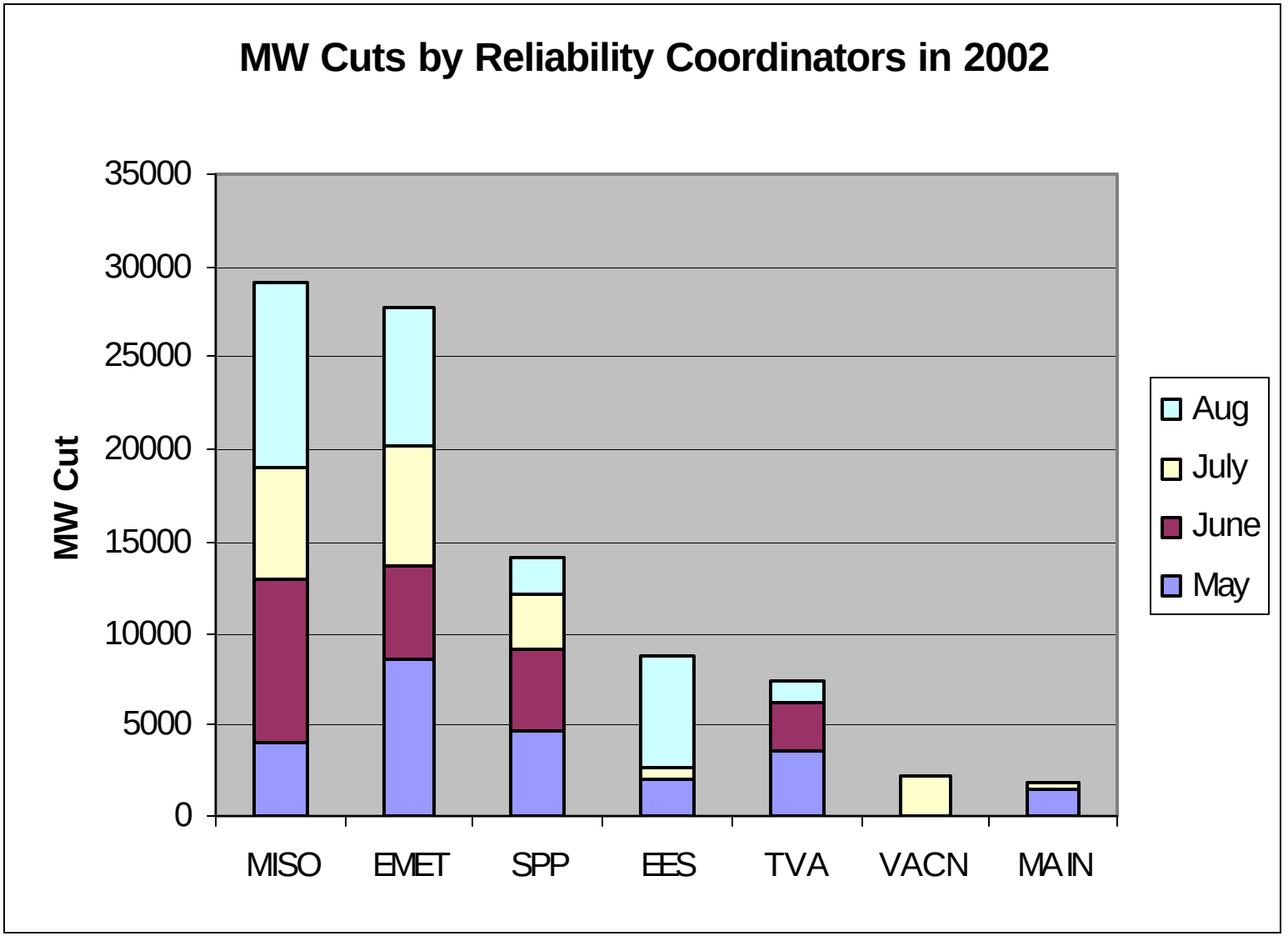
Real Time Constraints

- Identify thermal, voltage, stability constraints due to normal or contingency operational criteria
- Monitor Real time Operating System Limits
- Address thermal and voltage constraints:
  - Local operating procedures
  - Scheduling approval process
  - Transmission Loading Relief (TLR)

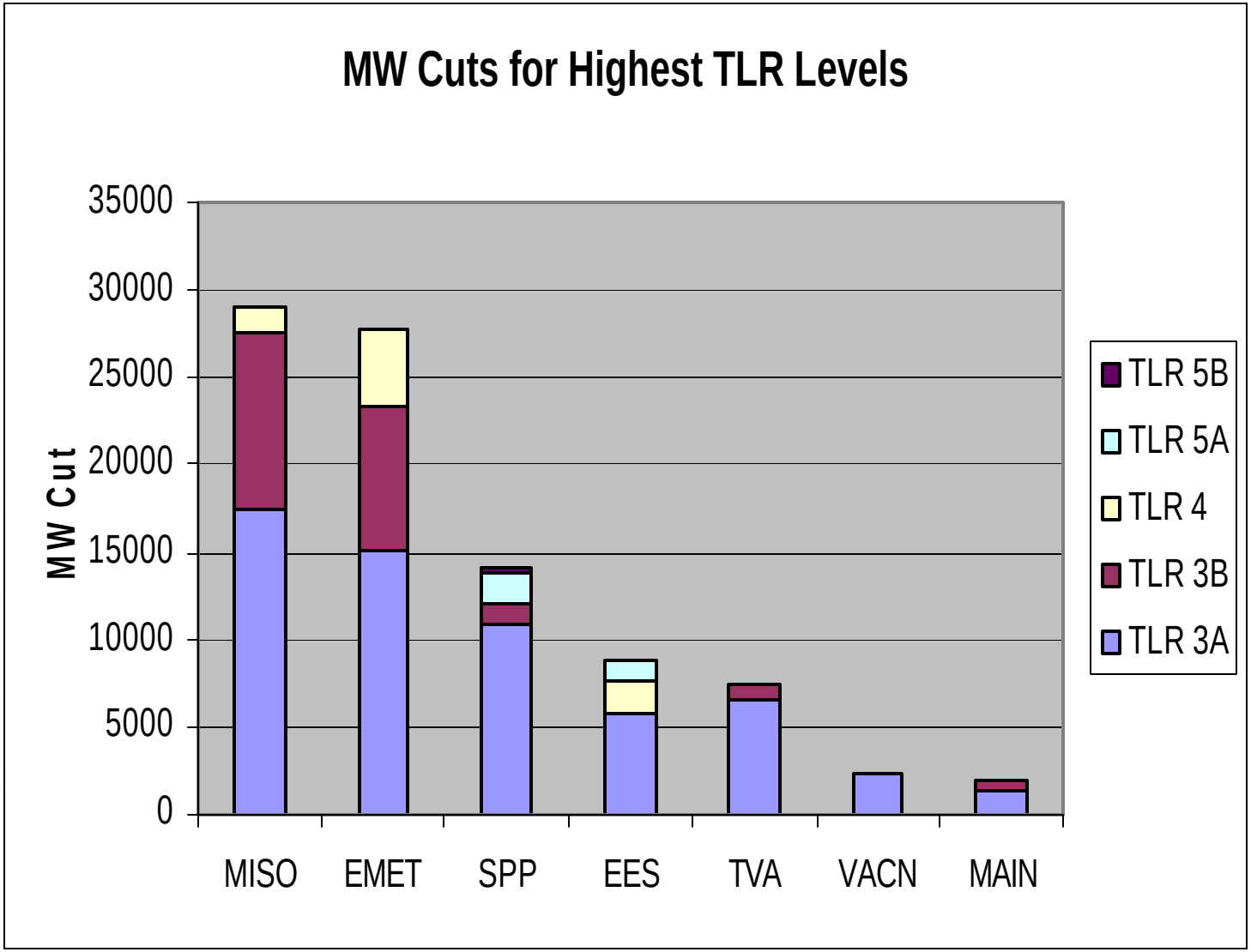
TLR Curtailment by Constrained Facility



TLR CURTAILMENTS



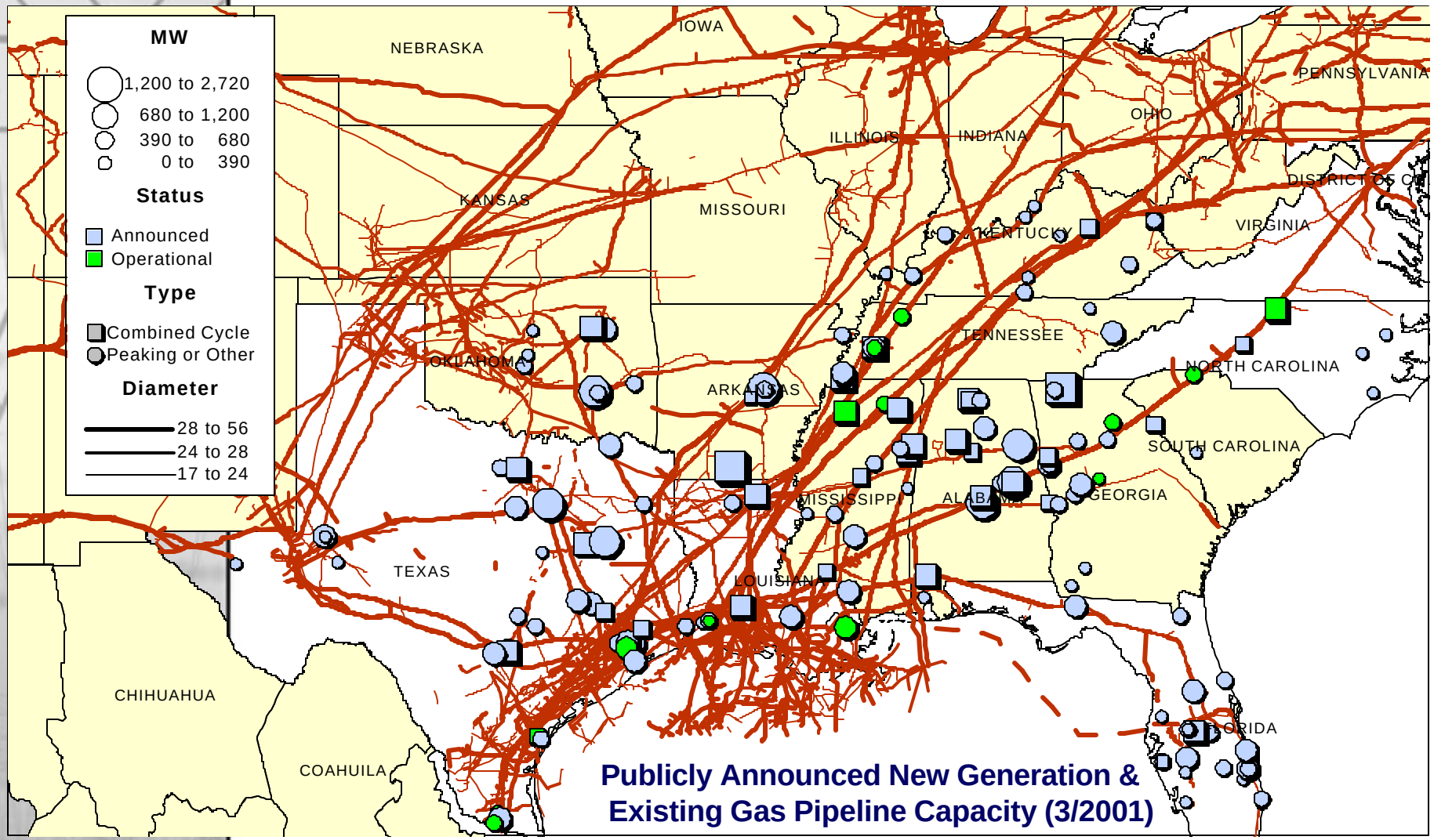
MWH Cuts vs. TLR Levels



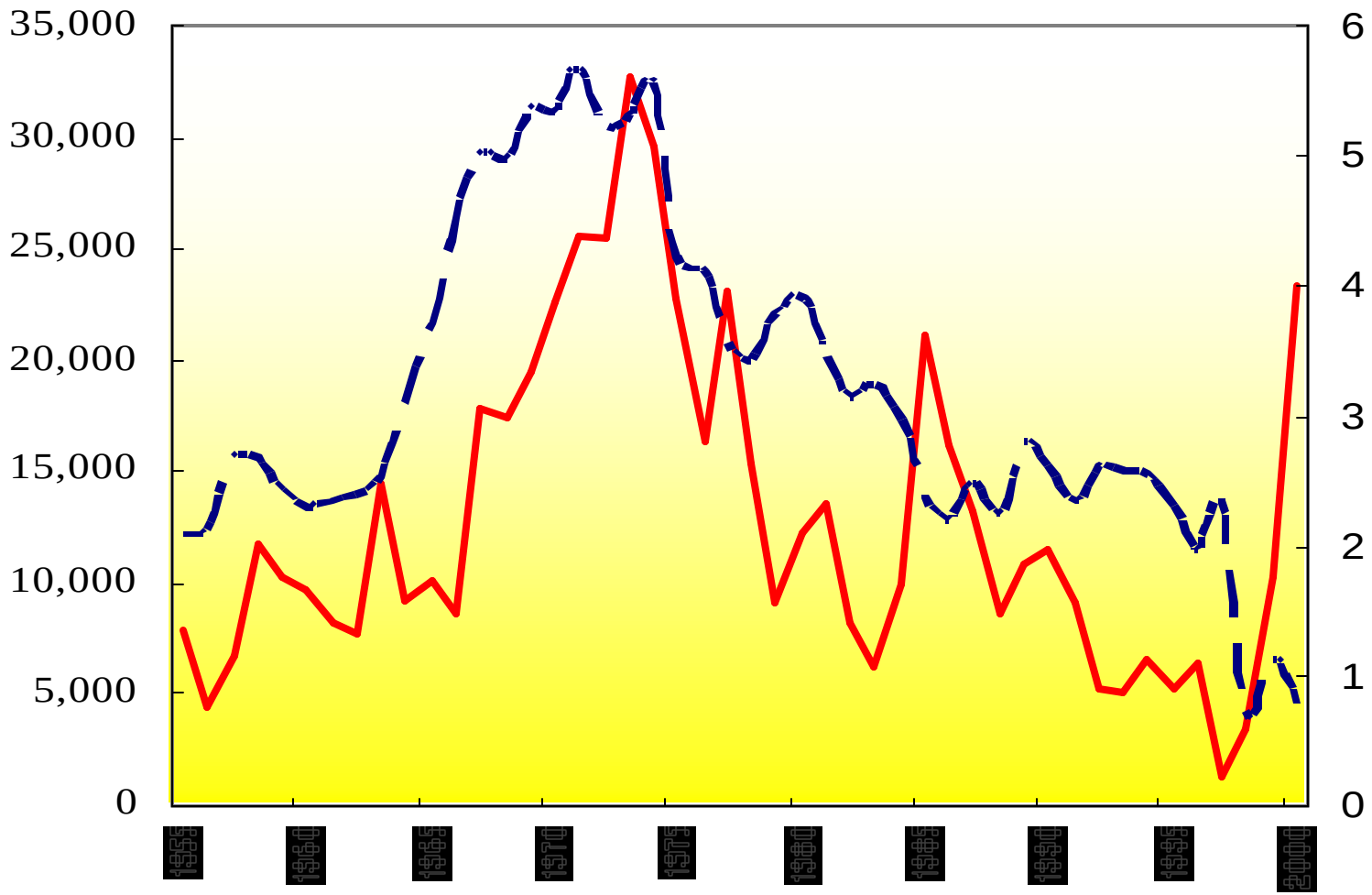
2002 versus 2001 Summer

- Natural gas price swings, weather diversities, and market attributes, ***single snapshot of the dominant seasonal transfer pattern is not adequate*** in capturing the operational effects of the Eastern Interconnection.
- In fact during 2002 Summer, ***West to East & South to North became the dominant transfer patterns*** per EPRI 2002 TagNet (no longer North to South pattern) .

U.S. New Generation Locations



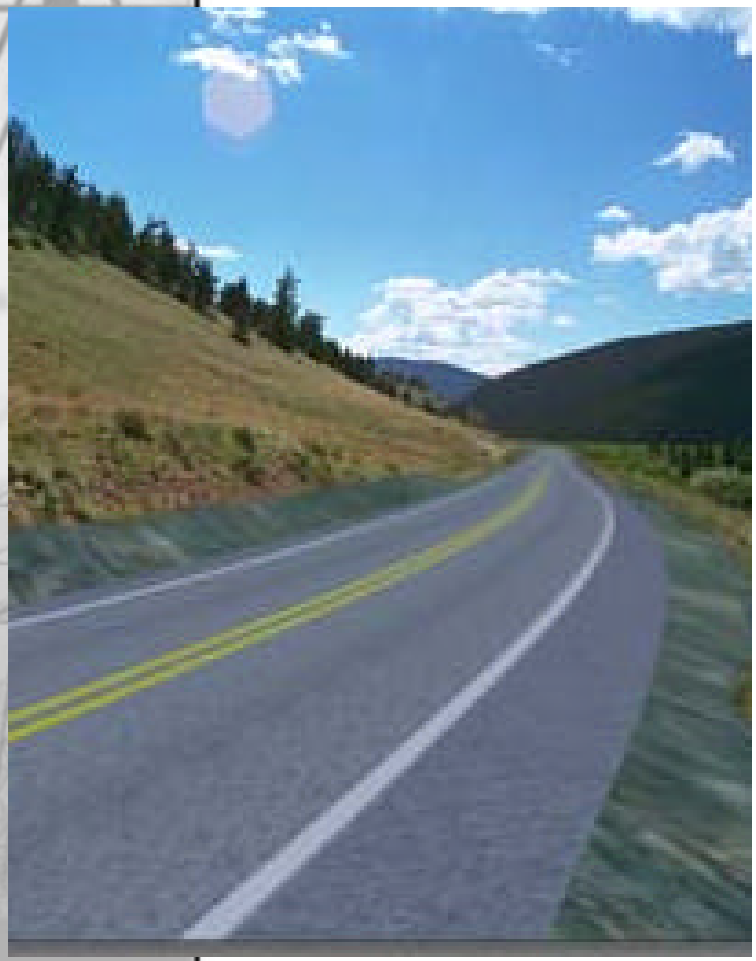
De-coupling of Investment



Source: EEI Statistical Yearbook and Energy Information Administration

A Prescription for Gridlock

A State Highway System . . .



. . . Being Used as an Interstate